

NAVIPAC 4

INTRODUCTION AND WORKFLOW

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Contents

| | | |
|----------|---|----------|
| 1 | Introduction to NaviPac | 3 |
| 2 | Program Environment | 4 |
| 3 | Hardware environment | 7 |
| 4 | Workflow example | 8 |
| 4.1 | Workflow: Creating a configuration | 9 |
| 4.1.1 | Start | 9 |
| 4.1.2 | Define the Vessel..... | 9 |
| 4.1.3 | Add GPS | 9 |
| 4.1.4 | Add Gyro..... | 10 |
| 4.1.5 | Add motion sensor | 10 |
| 4.1.6 | Add echo sounder..... | 11 |
| 4.1.7 | Define instruments for an ROV via USBL..... | 11 |
| 4.1.8 | Add position for the ROV | 11 |
| 4.2 | Workflow: Going Online..... | 13 |

1 Introduction to NaviPac

In this document, the various components in the NaviPac software will be briefly described.

An example of a hardware configuration is then outlined, as well as a simple workflow of using the software.

The NaviPac navigation software consists of several sub-parts, but from a user's point of view it can be divided into 2 main parts: the Configuration scenario and the Online data acquisition scenario, illustrated by Figure 1.

Use the Configuration program to define the geodesy and instrument setup. The Online part of the system collects various sensor data and calculates a final filtered position, among others. a/o.

For further details, please refer to the EIVA homepage www.eiva.com.

2 Program Environment

Below, the NaviPac software environment is outlined.

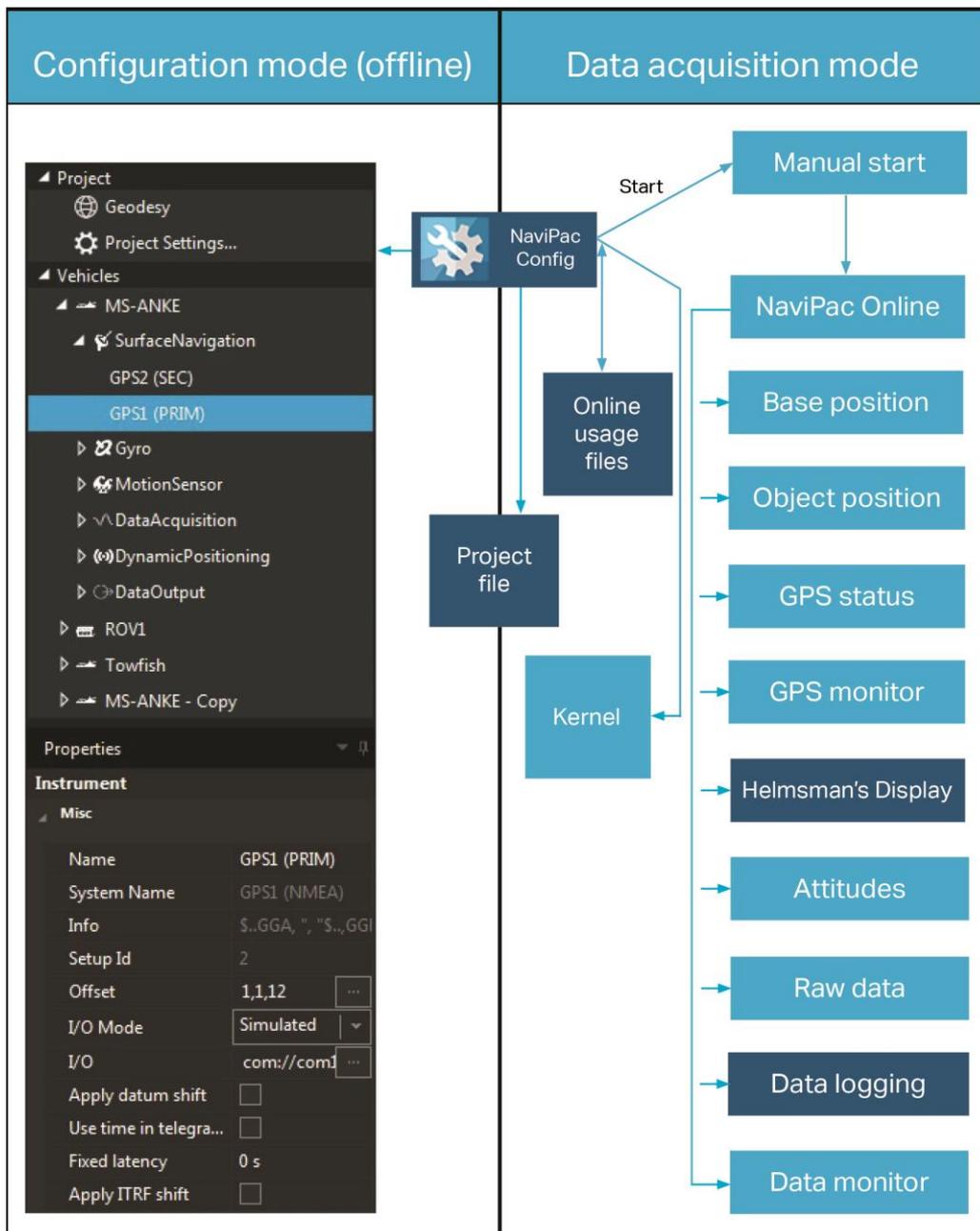


Figure 1 NaviPac software environment

The system is described as 5 primary blocks:

1. The **NaviPac Config(uration)** program (called NaviPac.EXE) does not depend on the other programs (it can be run by itself). Everything that the user sets up with the program is stored in a NaviPac project file (an XML file containing the entire setup).
2. The **Kernel** represents a series of background processes that handle interfacing, calculations and distribution.
3. The **Data Input** program reads data from the connected instruments connected to the serial ports (eg data from GPS, Gyro, Speed Log etc).
4. The **QC/Kernel** programs calculate the final position based on the selected lines of position (LOPs) by filtering data from the sensors and then calculate a predicted position, which will be used in the next calculation.
5. The **Data Distributor** periodically reads data from the **QC/Kernel** and distributes it to running GUI processes that have requested data to be displayed (eg position, gyro in the Online main window, quality control information in the quality control window(s), position data to Helmsman's Display etc).

The **Data Input**, **QC/Kernel**, **Data Distributor** and the **Online** programs will be started from Configuration using the **Start** command (clicking the **Start** button). During this process, the system reads the project file and prepares the real-time scenario based on:

- A static part created by the Setup (Configuration) program
- A dynamic part where current LOP selection etc is created during the start process

Both parts are created in internal temporary working files (differing from the projects) located in the EIVA folder where the software is installed.

The **Online** program handles the entire navigation operation (eg selection of LOPs, collection of sensor data, computation of positions, presentation of data, calibration, adjustment of navigation attributes etc). This program can be executed (displayed) on many computers at the same time. The dynamic information (of LOPs included etc) is stored in a system file called the **Online database** (the physical name is ONLSETUP.DB). Only the Online program can modify this system file, with the **QC/Kernel** using it heavily.

The **Online database** will include the following information:

| Information | Includes |
|---|--|
| Selected position source | Definition of the selected instruments (GPS, tracking systems etc) used for the vessel navigation. |
| Selected objects for dynamic positioning | Definition of objects and systems selected for UW or remote positioning. |
| Control parameters | Various parameters used for navigation control (C-O, weight, sigma, filters, priorities etc.). |
| POIs (Fixed offsets) | Information about the user-defined offsets in action. |
| Estimated Position | Last known position for estimation. |
| Navigation Mode | Last used navigation mode. |
| Time Control | Defines how the NaviPac time is controlled (GPS, PC etc). |

Table 1 Information stored in the Online database

The Configuration program handles definition of the project and global system parameters and will in most cases be inactive during most of the operational time. The program is limited to the master computer at the time of operation.

The NaviPac Configuration program saves information in a project file (**Setup database**). The system setup includes all static background information needed throughout operation and may even include additional unused information. There will not be any need for change in this setup unless basic information is changed.

The **Setup database** will include the following information:

| Information | Includes |
|--|--|
| Selected Projection | Definition of the selected projection (eg UTM-32) including projection type, projection name and various projection parameters. |
| Selected Ellipsoid | Definition of the selected ellipsoid (eg International 1924) including ellipsoid type, ellipsoid name and various ellipsoid parameters. |
| Defined Datum shift | Definition of the defined datum shift (between WGS 84 and user datum) including all 7 parameters. |
| ITRF | If ITRF is enabled – and the given base parameters if so |
| Height reference | Geoidal separation information. |
| Included Surface Navigation Systems | List of all included surface navigation systems (eg GPS, Laser tracking systems etc). |
| Defined Instruments | List of included instruments given by type (eg Surface Navigation, Gyro), instrument (Trimble GPS), layback offsets, I/O mode (On, Off, Simulated or Calculated) and I/O set-up. |
| Additional Instrument Parameters | For each instrument in the above list, this part includes additional parameters if needed. |
| Data Scale | Selected position and depth unit (eg Metric or US Survey Feet). Currently not available |
| Project parameters | A series of job-related parameters. |

Table 2 Information stored in the Setup database

Note: The entire configuration is kept in one file, which can be stored wherever desired.

3 Hardware environment

There are no limits on the number of computers that NaviPac can be installed on. The only requirements are (that):

- TCP/IP network protocol is installed on all computers
- Windows 7/10 or higher
- NaviPac is installed with a dongle on the master computer (server) – all other computers are NaviPac ‘remotes (clients) that do no interfacing, but present different functions (like Helmsman’s Display) to the users

Note: Besides network connections, dual or higher video boards can be used to provide more screen space to the applications (video splitters are another alternative)

4 Workflow example

A **typical** workflow using the NaviPac programs is difficult to describe, as any workflow depends on the task to be solved. Still, in this section, some sample workflows will be described. In this chapter, we assume that the user wants to create a new Setup database with some basic instruments defined before the NaviPac Online system is started.

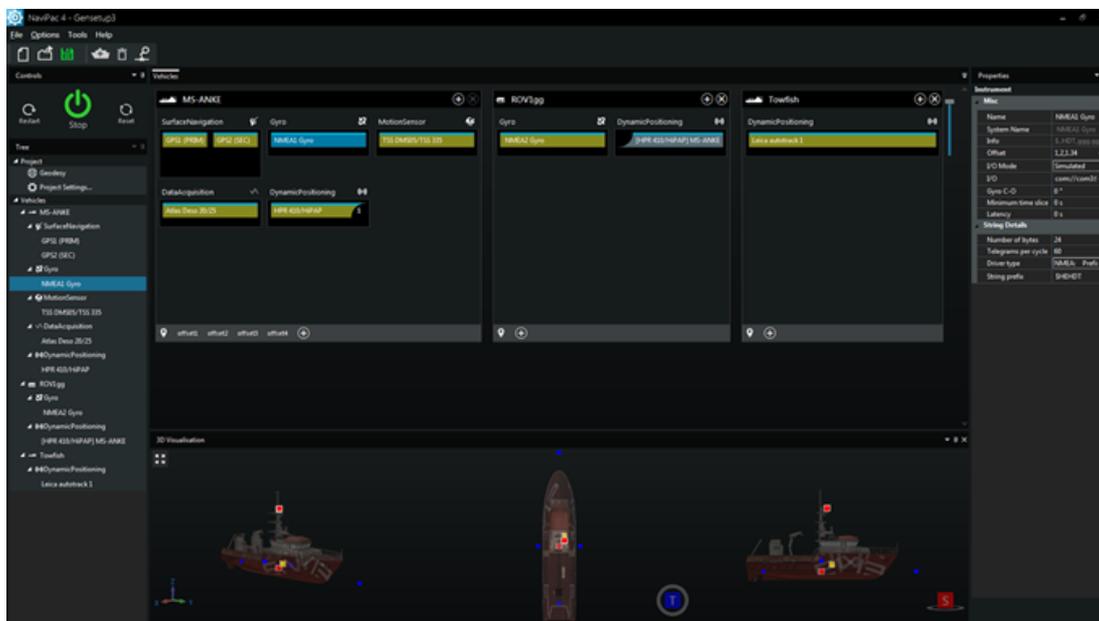


Figure 2 NaviPac Configuration sample setup

4.1 Workflow: Creating a configuration

The steps to go through to set up the NaviPac system might be:

4.1.1 Start

- Start the Configuration program
 - The program can be found on the Windows desktop; otherwise, use the Windows NaviPac program group
- The most recent Setup database will automatically be loaded
- To create a new database from scratch:
 - Select **File: New**
 - Select **File: Save As**
 - Save the file to your preferred name and location
- Set up **Projections & Ellipsoids**
 - Select the **Geodesy** item in the **Project tree**
 - In the **Properties** window, select **Projection** by clicking ...
 - Perform the setup and accept by clicking **OK**
- Set up **Datum Shift**
 - Select **Geodesy** in the **Project tree**
 - In the **Properties** window, select **Datum Shift** by clicking ...
 - Perform the setup and accept by clicking **OK**

4.1.2 Define the Vessel

In the **Vehicles** window:

- Select **Main Vessel**
- In the Properties window type in the wanted vessel name
- Accept by pressing the **Enter** key
- Select the 3D model of the vessel by clicking ...
Note: The vessel shape must be a 3DS drawing

4.1.3 Add GPS

In the **Vehicles** window:

- Select **Main Vessel**
- Click the **+** icon at the upper right corner
- Expand **Surface Navigation**
- Select the sensor you want to add
- Accept by clicking **OK**
- Select the correct interfacing setup

- Accept by clicking **OK**
- The instrument is added to the list and selected
Note: Sensor details are shown in the right part of the **Properties** window.
- Enter the offsets from CRP (common reference point) to sensor (X across vessel + starboard, Y along vessel + front, Z plus up) in the **Offset** section
- If you are using an ellipsoid different from WGS84 and have defined a datum shift, select **Apply Datum Shift**
Note: Please consider carefully how time tagging of the sensor is performed (eg refer to the NaviPac manual on timing principles)
- You may enter in preferred names for the instruments as this helps in identifying the right sensor at a later stage

4.1.4 Add Gyro

In the **Vehicles** window:

- Select **Main Vessel**
- Click the **+** icon at the upper right corner
- Expand **Gyro**
- Select the sensor you want to add
- Accept by clicking **OK**
- Select the correct interfacing setup
- Accept by clicking **OK**
- The instrument is added to the list and selected (sensor details are shown on the right of the **Properties** window)
- You may enter a sensor C-O (a value that will be added to the observed data) to compensate for mounting misalignments
- You may enter your own name for the instruments as this helps identifying the right sensor at a later stage

4.1.5 Add motion sensor

In the **Vehicles** window:

- Select **Main Vessel**
- Click the **+** icon at the upper right corner
- Expand **Motion Sensor**
- Select the sensor you want to add
- Accept by clicking **OK**
- Select the correct interfacing setup
- Accept by clicking **OK**
- The instrument is added to the list and selected (sensor details are shown at the right of the **Properties** window)

- You may enter a sensor C-O values for roll and pitch (values that will be added to the observed data) to compensate for mounting misalignments
- You may enter your own name for the instruments as this helps identifying the right sensor at a later stage

4.1.6 Add echo sounder

In the **Vehicles** window:

- Select **Main Vessel**
- Click the **+** icon at the upper right corner
- Expand **Data Acquisition**
- Select the sensor you want to add
- Accept by clicking **OK**
- Select the correct interfacing setup
- Accept by clicking **OK**
- The instrument is added to the list and selected (sensor details are shown at the right of the **Properties** window)
- You may enter your own name for the instruments to help identify the right sensor at a later stage
- For each channel on the acquisition sensor (up to 3 – eg DESO 25 may have 3) the channels are shown below the sensor:
 - Select the channel
 - Enter a reasonable name
 - Click **Active**
 - Enter offsets (if there)
 - Define data units, if not selected as OK by the software

4.1.7 Define instruments for an ROV via USBL

- Click the **Vessel +** icon  in the toolbar
- Enter name of the vehicle
- Select subsurface
- A second object is added to the list
- Select the item in the list
- Select 3D drawing if any

4.1.8 Add position for the ROV

- Select the main vessel
- Click the **+** icon at the upper right corner in the **Vessel** window
- Expand **Dynamic Positioning**
- Select the sensor (eg HPR 410/HiPAP) you want to add

- Accept by clicking **OK**
- Select the correct interfacing setup
- The instrument is added to the list and selected (sensor details are shown at the right of the **Properties** window)
- If desired, enter a more reasonable name for the instruments to help identify the right sensor at a later stage
- Enter the offsets from CRP to transducer reference point (X across vessel + starboard, Y along vessel + front, Z + up)
- Enter USBL hold time (default: 5 seconds) to define data timeout
- Enter correct settings for USBL hold Time (5 seconds or more) and USBL mountings

Note: Please consider carefully how time tagging of the sensor is performed (eg refer to the NaviPac manual on timing principles)

- Hover over **0** under Dynamic Positioning, which will turn into a **+**
- Move the mouse to the box and let it hover on the zero, which becomes a **+**



Figure 3 Dynamic Positioning 0 to +

- Click on **+**
 - Select the name of the ROV in the list
 - A USBL entry is now added to the ROV instrument list and linked to the vessel USBL (check by hovering mouse)
 - Select the ROV USBL item
 - Enter a TP code corresponding to the settings in the USBL system
 - Enter other USBL-specific parameters if needed
 - You may now add instruments (Gyro, Motions Sensor, Data Acquisition and DVL) to the ROV as done for the vessel earlier
- Note:** Remember to select the correct **Location**
- **Save** the current defined setup by selecting **File: Save** or by clicking the green **Save** icon (this will create a Setup database – name and location can be freely selected)

4.2 Workflow: Going Online

In the following, it is assumed that the user has created a Setup database as described above in section 4.1 and that the user wants to start from scratch (eg no navigation system is running).

The steps to do this for the Online navigation would be as follows:

- Start the Online program (from the Configuration program, click the **Start** button).
- From the dialogue box that pops up, select the positioning systems desired during the navigation session.
Note: It is also possible to select if the ROV should be positioned or not (ie moved from **Available** to **Included**. This functionality can also be used when the system is started).
- Click **OK**.
- A new dialogue box appears – here, specify an estimated position of the ship (the last one entered will be shown).
- Click **OK** and the background processes will be started (**Data I/O, Kernel, etc**).
Note: Regarding background processes: If physical sensors are connected, an estimated position will be updated each second in the Online main window. If an alarm condition is triggered, the background colour of the status field will be red (a red colour will be used as background colour in the status field). If all instruments are simulated, type a speed and gyro value in the **Simulator** window to simulate a move of the ship, and thereby update positions.

The next task for the navigator depends on the situation. If alarms occur (red state and alarm messages presented in message list) a typical task would be to start up **Base Positions** and watch the different LOP data:

- Watch the error and standard deviation values in **Base Positions** and find out which navigation system is the error source. The low quality LOPs are normally weighted down automatically. Navigation mode can be set to **Auto Prioritised Positioning** in the **Navigation Mode** menu item in the **Navigation** menu. The priority groups and reference group can be changed by selecting the **Navigation, Navigation Mode, Change Priority** menu in the Online main window.
- If some of the connected sensors seem to give seemingly unusable data, the raw data from the sensors can be studied on the port by selecting **View: Raw Data**. This will start up a program where the ports can be selected one by one, so you can check if the data matches expectations.